<110> Langermann, Solomon
      Revel, Andrew
      Auguste, Christine
      Burlein, Jeanne

<120>   FimH Adhesin Proteins and Methods of Use

<130>   469201-549

<150>   US/60/216,750
<151>   2000-07-07

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aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaacaacta taacagcgat      420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc tactggcggc      480
tgcgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccctgg ttcagtgcca      540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca      600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc tgcacagggc      660
gtcggcgtac agttgacgcg caacggtacg attattccag cgaataacac ggtatcttta      720
ggagcagtag ggacttcggc ggtgagtctg ggattaacgg caaattatgc acgtaccgga      780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgacttttgt ttatcaa       837
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6
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<210> 16
<211> 837
<212> DNA
<213> E. coli

<400> 16
atcgcctgta aaaccgccaa tggcaccgct atccctattg gcggtggcag cgccaatgtt      60
tatgtaaacc ttgcgcccgc cgtgaatgtg gggcaaaacc tggtcgtaga tctttcgacg     120
caaatctttt gccataacga ttacccggaa accattacag actatgtcac actgcaacga     180
ggttcggctt atggcggcgt gttatctcat ttttccggga ccgtaaaata tagtggcagt     240
agctatccat tcctaccac cagcgaaacg ccgcgcgttg tttataattc gagaacggat      300
aagccgtggc cggtggcgct ttatttgacg cctgtgagca gtgcgggtgg ggtggcgatt     360
aaggctggct càttaatggc tgtgctaatt ttgcgacaga ccaataacta taacagcgat     420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc cactggcggc     480
tgtgatgttt ctgctcgtga tgtcaccgtt actctgccag actaccctgg ttcagtgccg     540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca     600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc tgcacagggc     660
gtcggcgtac agttaacgcg caacggtacg attaatccag cgaataacac ggtatcgtta     720
ggagcagtag ggacttcggc ggtaagtctg ggattaacgg caaattacgc acgtaccgga     780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgactttgt ttatcaa         837


<210> 17
<211> 837
<212> DNA
<213> E. coli

<400> 17
ttcgcctgta aaaccgccaa tggtaccgct atccctattg gcggtggcag cgccaatgtt      60
tatgtaaacc ttgcgcccgt cgtgaatgtg gggcaaaacc tggtcgtgga tctttcgacg     120
caaatctttt gccataacga ttatccggaa accattacag actatgtcac actgcaacga     180
ggctcggctt atggcggcgt gttatctaat ttttccggga ccgtaaaata tagtggcagt     240
agctatccat tcctaccac cagcgaaacg ccgcgcgttg tttataattc gagaacggat      300
aagccgtggc cggtggcgct ttatttgacg cctgtgagca gtgcgggcgg ggtggcgatt     360
aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaacaacta taacagcgat     420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc tactggcggc     480
tgcgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccgtgg ttcagtgcca     540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca     600
cacgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc tgcacagggc     660
gtcggcgtac agttgacgcg caacggtacg attattccag cgaataacac ggtatcgtta     720
ggagcagtag ggacttcggc ggtgagtctg ggattaacgg caaattatgc acgtaccgga     780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgactttgt ttatcaa         837


<210> 18
<211> 837
<212> DNA
<213> E. coli

<400> 18
ttcgcctgta aaaccgccaa tggtaccgct atccctattg gcggtggcag cgccaatgtt      60
tatgtaaacc ttgcgcctgc cgtgaatgtg gggcaaaacc tggtcgtgga tctttcgacg     120
caaatctttt gccataacga ttacccggaa accattacag actatgtcac actgcaacga     180
ggttcggctt atggcggcgt gttatctagt ttttccggga ccgtaaaata taatggcagt     240
agctatcctt tcctactac cagcgaaacg ccgcgggttg tttataattc gagaacggat      300
aagccgtggc cggtggcgct ttatttgacg cctgtgagca gtgcgggggg agtggcgatt     360
aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaacaacta taacagcgat     420

7

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gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc cactggcggc      480
tgcgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccctgg ttcagtgccg      540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca      600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc cgcgcagggc      660
gtcggcgtac agttggcgcg caacggtacg gttattccag cgaataacac ggtatcgtta      720
ggagcagtag ggacttcggc ggtaagtctg ggattaacgg caaattacgc acgtaccgga      780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgactttgt ttatcaa        837


<210>  19
<211>  837
<212>  DNA
<213>  E. coli

<400>  19
ttcgcctgta aaaccgccaa tggtaccgca atccctattg gcggtggcag cgccaatgtt       60
tatgtaaacc ttgcgcctgc cgtgaatgtg gggcaaaacc tggtcgtaga tctttcgacg      120
caaatctttt gccataacga ttacccagaa accattacag actatgtcac actgcaacga      180
ggttcggctt atggcggcgt gttatctagt ttttccggga ccgtaaaata taatggcagt      240
agctatcctt tccctactac cagcgaaacg ccgcgggttg tttataattc gagaacggat      300
aagccgtggc cggtggcgct ttatttgacg ctggtgagca gtgcgggggg agtggcgatt      360
aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaacaacta aacagcgat       420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc cactggcggc      480
tgtgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccctgg ttcagtgccg      540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct atccggcaca      600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc cgcgcagggc      660
gtcggcgtac agttgacgcg caacggtacg gttattccag cgaataacac ggtatcgtta      720
ggagcagtag ggacttcggc ggtaagtctg ggattaacgg caaattacgc acgtaccgga      780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgactttgt ttatcaa        837


<210>  20
<211>  837
<212>  DNA
<213>  E. coli

<400>  20
ttcgcctgta aaaccgccaa tggtaccgct atccctattg gcggtggcag cgctaatgtt       60
tatgtaaacc ttgcgcctgc cgtgaatgtg gggcaaaacc tggtcgtaga tctttcgacg      120
caaatctttt gccataacga ttatccggaa accattacag actatgtcac actgcaacga      180
ggctcggctt atggcggcgt gttatctaat ttttccggga ccgtaaaata tagtggcagt      240
agctatccat tccgaccac cagcgaaacg ccgcgggttg tttataattc gagaacggat      300
aagccgtggc cggtggcgct ttatttgacg cctgtgagca gtgcgggcgg ggtggcgatt      360
aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaaaaacta aacagcgat       420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtagtgcc tactggcggc      480
tgcgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccctgg ttcagtgcca      540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca      600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc agcgcagggc      660
gtcggcgtac agttgacgcg caacggtacg gttattccag cgaataacac ggtatcgtta      720
ggaacagtag gaacttcggc ggtaagtctg ggattaacgg caaattacgc acgtaccggc      780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgactttgt ttatcaa        837


<210>  21
<211>  837
<212>  DNA
<213>  E. coli
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8

<400> 21

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ttcgcctgta aaaccgccaa tggtaccgct atccctattg gcggtggcag cgccaatgtt     60
tatgtaaacc ttgcgcccgt cgtgaatgtg gggcaaaacc tggtcgtgga tctttcgacg    120
caaatctttt gccataacga ttatccggaa accattacag actatgtcac actgcaacga    180
ggctcggctt atggcggcgt gttatctaat ttttccggga ccgtaaaata tagtggcagt    240
agctatccat ttcctaccac cagcgaaacg ccgcgcgttg tttataattc gagaacggat    300
aagccgtggc cggtggcgct ttatttgacg cctgtgagca gtgcgggcgg ggtggcgatt    360
aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaacaacta taacagcgat    420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc tactggcggc    480
tgcgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccctgg ttcagtgcca    540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca    600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc tgcacagggc    660
gtcggcgtac agttgacgcg caacggtacg attattccag cgaataacac ggtatcgtta    720
ggagcagtag ggacttcggc ggtgagtctg ggattaacgg caaattatgc acgtaccgga    780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgacttttgt ttatcaa       837
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<210> 22
<211> 837
<212> DNA
<213> E. coli

<400> 22

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ttcgcctgta aaaccgccaa tggtaccgca atccctattg gcggtggcag cgccaatgtt     60
tatgtaaacc ttgcgcctgc cgtgaatgtg gggcaaaacc tggtcgtaga tctttcgacg    120
caaatctttt gccataacga ttacccagaa accattacag actatgtcac actgcaacga    180
ggtgcggctt atggcggcgt gttatctagt ttttccggga ccgtaaaata taatggcagt    240
agctatcctt tccctactac cagcgaaacg ccgcgggttg tttataattc gagaacggat    300
aagccgtggc cggtggcgct ttatttgacg ccggtgagca gtgcgggggg agtggcgatt    360
aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaacaacta taacagcgat    420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc cactggcggc    480
tgcgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccctgg ttcagtgccg    540
attcctctta ccgtttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca    600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc cgcgcagggc    660
gtcggcgtac agttgacgcg caacggtacg attattccag cgaataacac ggtatcgtta    720
ggagcagtag ggacttcggc ggtaagtctg ggattaacgg caaattacgc acgtaccgga    780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgacttttgt ttatcaa       837
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<210> 23
<211> 279
<212> PRT
<213> E. coli

<400> 23

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Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5                   10                  15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Val Val Asn Val Gly Gln
            20                  25                  30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35                  40                  45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50                  55                  60

Gly Gly Val Leu Ser Asn Phe Ser Gly Ile Val Lys Tyr Ser Gly Ser
```

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
                100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
                115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
        130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Ala Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
                165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
                180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Ala Arg Asn Gly Thr Val Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
                245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
                260   265   270

Gly Val Thr Phe Val Tyr Gln
            275

<210>   24
<211>   279
<212>   PRT
<213>   E. coli

<400>   24
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
                20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
        50   55   60

10

```
Gly Gly Val Leu Ser Ser Phe Ser Gly Ile Val Lys Tyr Asn Gly Ser
65              70              75              80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85              90              95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100             105             110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115             120             125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130             135             140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145             150             155             160

Cys Asp Ala Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165             170             175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180             185             190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195             200             205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210             215             220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225             230             235             240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245             250             255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260             265             270

Gly Val Thr Phe Val Tyr Gln
        275

<210>  25
<211>  279
<212>  PRT
<213>  E. coli

<400>  25
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5               10              15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20              25              30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35              40              45
```

11

```
Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ala Ala Tyr
    50              55                  60

Gly Gly Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65              70                  75                  80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85                  90                  95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100             105             110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115             120             125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130             135             140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145             150             155             160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165             170             175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180             185             190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195             200             205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210             215             220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225             230             235             240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245             250             255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260             265             270

Gly Val Thr Phe Val Tyr Gln
        275

<210>   26
<211>   279
<212>   PRT
<213>   E. coli

<400>   26
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5                   10                  15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20                  25                  30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
```

12

```
          35                        40                        45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ala Ala Tyr
    50                  55                  60

Gly Gly Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65                  70                  75                  80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85                  90                  95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100                 105                 110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
            115                 120                 125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130                 135                 140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145                 150                 155                 160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165                 170                 175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180                 185                 190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195                 200                 205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210                 215                 220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225                 230                 235                 240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245                 250                 255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260                 265                 270

Gly Val Thr Phe Val Tyr Gln
        275

<210>  27
<211>  279
<212>  PRT
<213>  E. coli

<400>  27
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5                   10                  15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20                  25                  30
```

13

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50   55   60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala His Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260   265   270

Gly Val Thr Phe Val Tyr Gln
            275

<210>   28
<211>   279
<212>   PRT
<213>   E. coli

<400>   28
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   ·5   10   15

14

Ser Ala Asn Val Tyr Val Asn Leu Ala Ile Ala Val Asn Val Gly Gln
   20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
   35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr .
  50   .   55   60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
     85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
    100   105   110

Ser Ser Ala Gly Gly Val Val Ile Lys Ala Gly Ser Leu Ile Ala Val
   115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
  130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
    165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
    180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
   195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
  210   215   220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
    245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
   260   265   270

Gly Ala Thr Phe Val Tyr Gln
   275

<210> 29
<211> 279
<212> PRT
<213> E. coli

<400> 29
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Val Val Asn Val Gly Gln
                20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
        50   55   60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Leu Val Ile Lys Ala Gly Ser Leu Ile Ala Val
        115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
                165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Thr Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260   265   270

Gly Val Thr Phe Val Tyr Gln
        275

<210> 30
<211> 280
<212> PRT
<213> E. coli

<400> 30

```
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5               10              15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20              25              30

Asn Leu Val Val Asp Leu Ser Thr Gln Thr Phe Cys His Asn Asp Tyr
        35              40              45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50              55              60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65              70              75              80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85              90              95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100             105             110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115             120             125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130             135             140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145             150             155             160

Cys Asp Val Ser Ala His Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165             170             175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180             185             190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
    195             200             205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210             215             220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225             230             235             240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245             250             255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
        260             265             270

Gly Val Thr Phe Val Tyr Gln Glx
        275             280
```

<210> 31
<211> 279

<212> PRT
<213> E. coli

<400> 31
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50   55   60

Gly Gly Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Ala Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
    195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260   265   270

Gly Val Thr Phe Val Tyr Gln
            275

<210> 32
<211> 279
<212> PRT
<213> E. coli

<400> 32
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50   55   60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Val Val Ile Lys Ala Gly Ser Leu Ile Ala Val
        115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Pro
                165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr Thr Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
                245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260   265   270

Gly Val Thr Phe Val Tyr Gln

<210> 33
<211> 279
<212> PRT
<213> E. coli

<400> 33
```
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5                  10                  15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20                  25                  30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35                  40                  45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ala Ala Tyr
    50                  55                  60

Gly Gly Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65                  70                  75                  80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85                  90                  95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100                 105                 110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115                 120                 125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130                 135                 140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145                 150                 155                 160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Pro
                165                 170                 175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180                 185                 190

Leu Gly Tyr Tyr Leu Ser Gly Thr Thr Ala Asp Ala Gly Asn Ser Ile
        195                 200                 205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210                 215                 220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225                 230                 235                 240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
                245                 250                 255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260                 265                 270
```

```
Gly Val Thr Phe Val Tyr Gln
        275
```

```
<210>   34
<211>   279
<212>   PRT
<213>   E. coli
```

```
<400>   34
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5                   10                  15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Val Val Asn Val Gly Gln
            20                  25                  30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35                  40                  45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
        50                  55                  60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65                  70                  75                  80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                    85                  90                  95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100                 105                 110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115                 120                 125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130                 135                 140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145                 150                 155                 160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Pro
            165                 170                 175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180                 185                 190

Leu Gly Tyr Tyr Leu Ser Gly Thr Thr Ala Asp Ala Gly Asn Ser Ile
        195                 200                 205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210                 215                 220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225                 230                 235                 240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245                 250                 255
```

21

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260   265   270

Gly Val Thr Phe Val Tyr Gln
            275

<210> 35
<211> 279
<212> PRT
<213> E. coli

<400> 35
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
                20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
        50   55   60

Gly Ser Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
            115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
            130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
                165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr

22

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
        260   265   270

Gly Val Thr Phe Val Tyr Gln
        275

<210> 36
<211> 279
<212> PRT
<213> E. coli

<400> 36
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Val Val Asn Val Gly Gln
        20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50   55   60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Val Val Ile Lys Ala Gly Ser Leu Ile Ala Val
        115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

23

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
                245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Arg Ser Ile Ile
            260   265   270

Ala Val Thr Phe Val Tyr Gln
        275

<210>   37
<211>   279
<212>   PRT
<213>   E. coli

<400>   37
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50   55   60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Glu Tyr Ser Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

24

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
                245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260   265   270

Gly Val Thr Phe Val Tyr Gln
        275

<210>   38
<211>   279
<212>   PRT
<213>   E. coli

<400>   38
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50   55   60

Gly Gly Val Leu Ser His Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Met Ala Val
            115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180   185   190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
        195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln

25

```
              210                    215                    220

    Leu Thr Arg Asn Gly Thr Ile Asn Pro Ala Asn Asn Thr Val Ser Leu
    225                 230                 235                 240

    Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
                    245                 250                 255

    Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
                    260                 265                 270

    Gly Val Thr Phe Val Tyr Gln
                275

    <210>  39
    <211>  279
    <212>  PRT
    <213>  E. coli

    <400>  39
    Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
    1               5                   10                  15

    Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
                20                  25                  30

    Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
                35                  40                  45

    Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
        50                  55                  60

    Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
    65                  70                  75                  80

    Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                    85                  90                  95

    Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
                100                 105                 110

    Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
                115                 120                 125

    Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
        130                 135                 140

    Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
    145                 150                 155                 160

    Cys Asp Val Ser Val Arg Asp Val Thr Val Ile Leu Pro Asp Tyr Arg
                    165                 170                 175

    Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
                180                 185                 190

    Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
            195                 200                 205
```

26

```
Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210                 215             220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225                 230             235                     240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245             250                     255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Lys Ser Ile Ile
        260             265             270

Gly Val Thr Phe Val Tyr Gln
        275
```

<210> 40
<211> 279
<212> PRT
<213> E. coli

<400> 40
```
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5               10              15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20              25              30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35              40              45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50              55              60

Gly Gly Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65              70              75              80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85              90              95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100             105             110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115             120             125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130             135             140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145             150             155             160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165             170             175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180             185             190
```

27

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210   215   220

Leu Thr Ala Asn Gly Thr Ile Val Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245   250   255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
        260   265   270

Gly Val Thr Phe Val Tyr Gln
        275

<210> 41
<211> 279
<212> PRT
<213> E. coli

<400> 41
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1   5   10   15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20   25   30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
        35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50   55   60

Gly Gly Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Leu Val
        100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
        115   120   125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130   135   140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145   150   155   160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165   170   175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn

28

```
                180                     185                     190
    Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
            195                 200                 205

    Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
            210                 215                 220

    Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
    225                 230                 235                 240

    Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
                245                 250                 255

    Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
                260                 265                 270

    Gly Val Thr Phe Val Tyr Gln
                275


<210>   42
<211>   279
<212>   PRT
<213>   E. coli

<400>   42
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1                   5                   10                  15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Val Val Asn Val Gly Gln
            20                  25                  30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35                  40                  45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
        50                  55                  60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65                  70                  75                  80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85                  90                  95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100                 105                 110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
            115                 120                 125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130                 135                 140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145                 150                 155                 160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
                165                 170                 175
```

29

```
Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180             185             190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
            195             200             205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210             215             220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225             230             235             240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245             250             255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260             265             270

Gly Val Thr Phe Val Tyr Gln
            275


<210>   43
<211>   279
<212>   PRT
<213>   E. coli

<400>   43
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5               10              15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20              25              30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35              40              45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50              55              60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65              70              75              80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85              90              95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100             105             110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
            115             120             125

Leu Ile Leu Arg Gln Thr Lys Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130             135             140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145             150             155             160
```

30

```
Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
            165                 170                 175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180                 185                 190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
            195                 200                 205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210                 215                 220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225                 230                 235                 240

Gly Thr Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
            245                 250                 255

Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
            260                 265                 270

Gly Val Thr Phe Val Tyr Gln
            275

<210>   44
<211>   279
<212>   PRT
<213>   E. coli

<400>   44
Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile Pro Ile Gly Gly Gly
1               5                   10                  15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Val Val Asn Val Gly Gln
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Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35                  40                  45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
    50                  55                  60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65                  70                  75                  80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
            85                  90                  95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100                 105                 110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
            115                 120                 125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
    130                 135                 140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
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31

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Pro
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Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
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Leu Gly Tyr Tyr Leu Ser Gly Thr Thr Ala Asp Ala Gly Asn Ser Ile
                195   200   205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
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Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225   230   235   240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
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Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
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Gly Val Thr Phe Val Tyr Gln
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Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
                35   40   45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ala Ala Tyr
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Gly Gly Val Leu Ser Ser Phe Ser Gly Thr Val Lys Tyr Asn Gly Ser
65   70   75   80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85   90   95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
                100   105   110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
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Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
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32

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Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
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Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
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Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
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Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
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Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210             215             220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225             230             235             240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
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Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
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Gly Val Thr Phe Val Tyr Gln
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33

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34

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<220>
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35

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<210>   48
<211>   903
<212>   DNA
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<220>
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<210>   49
<211>   814
<212>   DNA
<213>   Artificial

<220>
<223>   Sequence of kanamycin R gene

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tatcgattgt atgggaagcc cgatgcgcca gagttgtttc tgaaacatgg cacaggtagc    180
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tgatgcgctg gcagtgttcc tgcgccggtt gcattcgatt cctgtttgta attgtccttt    420
taacagcgat cgcgtatttc gtctcgctca ggcgcaatca ccaatgaata cggtttggt    480
tgatgcgagt gatttgatg acgagcgtaa tggctggcct gttgaacaag tctggaaaga    540
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taataacctt atttttgacg aggggaaatt aataggttgt attgatgttg gacgagtcgg      660
aatcgcagac cgataccagg atcttgccat cctatggaac tgcctcggtg agttttctcc      720
ttcattacag aaacggcttt ttcaaaaata tggtattgat aatcctgata tgaataaatt      780
gcagtttcat ttgatgctcg atgagttttt ctaa                                  814


<210>   50
<211>   1085
<212>   DNA
<213>   Artificial


<220>
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<211>   862
<212>   DNA
<213>   Sequence of beta-lacyamase gene

<400>   51
atgagtattc aacatttccg tgtcgccctt attccctttt ttgcggcatt ttgccttcct       60
gtttttgctc acccagaaac gctggtgaaa gtaaaagatg ctgaagatca gttgggtgca      120
cgagtgggtt acatcgaact ggatctcaac agcggtaaga tccttgagag ttttcgcccc      180
gaagaacgtt ttccaatgat gagcactttt aaagttctgc tatgtggcgc ggtattatcc      240
cgtattgacg ccgggcaaga gcaactcggg tcgccgcata cactattctc agaatgactt      300
ggttgagtac tcaccagtca cagaaaagca tcttacggat ggcatgacag taagagaatt      360
atgcagtgct gccataacca tgagtgataa cactgcggcc aacttacttc tgacaacgat      420
cggaggaccg aaggagctaa ccgctttttt gcacaacatg ggggatcatg taactcgcct      480
tgatcgttgg gaaccggagc tgaatgaagc cataccaaac gacgagcgtg acaccacgat      540
gcctgtagca atgcaacaac gttggcgcaa actattaact ggcgaactac ttactctagc      600
ttcccggcaa caattaatag actggatgga ggcggataaa gttgcaggac cacttctgcg      660
ctcggccctt ccggctggct ggtttattgc tgataaatct ggagccggtg agcgtgggtc      720
tcgcggtatc attgcagcac tggggccaga tggtaagccc tcccgtatcg tagttatcta      780
cacgacgggg agtcaggcaa ctatggatga acgaaataga cagatcgctg agataggtgc      840
ctcactgatt aagcattggt aa                                               862
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<210> 52
<211> 601
<212> DNA
<213> Artificial

<220>
<223> Sequence of the origin of replication

<400> 52
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tttttctgcg cgtaatctgc tgcttgcaaa caaaaaaacc accgctacca gcggtggttt    60
gtttgccgga tcaagagcta ccaactcttt ttccgaaggt aactggcttc agcagagcgc   120
agataccaaa tactgttctt ctagtgtagc cgtagctagg ccaccacttc aagaactctg   180
tagcaccgcc tacatacctc gctctgctaa tcctgttacc agtggctgct gccagtggcg   240
ataagtcgtg tcttaccggg ttggactcaa gacgatagtt accggataag cgcagcggt   300
cgggctgaac ggggggttcg tgcacacagc ccagcttgga gcgaacgacc tacaccgaac   360
tgagatacct acagcgtgag ctatgagaaa gcgccacgct tcccgaaggg agaaaggcgg   420
acaggtatcc ggtaagcggc agggtcggaa caggagagcg cacgagggag cttccagggg   480
gaaacgcctg gtatctttat agtcctgtcg ggtttcgcca cctctgactt gagcgtcgat   540
ttttgtgatg ctcgtcaggg gggcggagcc tatggaaaaa cgccagcaac gcggcctttt   600
t                                                                   601
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<210> 53
<211> 116
<212> DNA
<213> Sequence of Lac p/o

<400> 53
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cgcaattaat gtgagttagc tcactcatta ggcaccccag gctttacact ttatgcttcc    60
ggctcgtatg ttgtgtggaa ttgtgagcgg ataacaattt cacacaggaa acagct       116
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<210> 54
<211> 837
<212> DNA
<213> E. coli

<400> 54
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ttcgcctgta aaaccgccaa tggtaccgct atccctattg gcggtggcag cgccaatgtt    60
tatgtaaacc ttgcgcccgt cgtgaatgtg gggcaaaacc tggtcgtgga tctttcgacg   120
caaatctttt gccataacga ttatccggaa accattacag actatgtcac actgcaacga   180
ggctcggctt atggcggcgt gttatctaat ttttccggga ccgtaaaata taatggcagt   240
agctatccat ttcctaccac cagcgaaacg ccgcgcgttg tttataattc gagaacggat   300
aagccgtggc cggtggcgct ttatttgacg cctgtgagca gtgcgggcgg ggtggcgatt   360
aaagctggct cattaattgc cgtgcttatt ttgcgacaga ccaacaacta taacagcgat   420
gatttccagt ttgtgtggaa tatttacgcc aataatgatg tggtggtgcc tactggcggc   480
tgcgatgttt ctgctcgtga tgtcaccgtt actctgccgg actaccctgg ttcagtgcca   540
attcctctta ccgttattg tgcgaaaagc caaaacctgg ggtattacct ctccggcaca   600
accgcagatg cgggcaactc gattttcacc aataccgcgt cgttttcacc tgcacagggc   660
gtcggcgtac agttgacgcg caacggtacg attattccag cgaataacac ggtatcgtta   720
ggagcagtag ggacttcggc ggtgagtctg ggattaacgg caaattatgc acgtaccgga   780
gggcaggtga ctgcagggaa tgtgcaatcg attattggcg tgactttgt ttatcaa        837
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38

<210> 55
<211> 279
<212> PRT
<213> Artificial

<220>
<223> Consensus sequence of FimH proteins for SEQ ID NO: 23 to 45

<400> 55

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1               5                   10              15

Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Ala Val Asn Val Gly Gln
            20                  25                  30

Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe Cys His Asn Asp Tyr
            35                  40                  45

Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln Arg Gly Ser Ala Tyr
        50                  55                  60

Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val Lys Tyr Ser Gly Ser
65                  70                  75                  80

Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro Arg Val Val Tyr Asn
                85                  90                  95

Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu Tyr Leu Thr Pro Val
            100                 105                 110

Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly Ser Leu Ile Ala Val
            115                 120                 125

Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser Asp Asp Phe Gln Phe
        130                 135                 140

Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val Val Pro Thr Gly Gly
145                 150                 155                 160

Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr Leu Pro Asp Tyr Arg
                165                 170                 175

Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys Ala Lys Ser Gln Asn
            180                 185                 190

Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp Ala Gly Asn Ser Ile
            195                 200                 205

Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln Gly Val Gly Val Gln
    210                 215                 220

Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn Asn Thr Val Ser Leu
225                 230                 235                 240

Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly Leu Thr Ala Asn Tyr
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Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn Val Gln Ser Ile Ile
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39

Gly Val Thr Phe Val Tyr Gln
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<210> 56
<211> 55
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA1F

<400> 56
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<210> 57
<211> 36
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA1R

<400> 57
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<210> 58
<211> 36
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA13F

<400> 58
cacacaggaa acagctatga ttgtaatgaa aacgag   36

<210> 59
<211> 39
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA6R

<400> 59
ggcgtcgacg gatccttatt gataaacaaa agtcacgcc   39

<210> 60
<211> 30
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA11F

<400> 60
ccgaataaag atatcacgac aggtttcccg   30

<210> 61
<211> 19
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA9R

<400> 61
catagctgtt tcctgtgtg   19

<210> 62
<211> 23
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA24F

<400> 62
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<210> 63
<211> 34
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA23R

<400> 63
gacgttttta ttactcatag ctgtttcctg tgtg   34

<210> 64
<211> 37
<212> DNA
<213> Artificial

<220>
<223> Oligonucleotide primer GA21F

<400> 64
atgagtaata aaaacgtcaa tgtaaggaaa tcgcagg   37